

## THE WORKING HOURS OF ANTS.

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During the summer of 1927 the writer observed the periods of activity of two species of ants in North Carolina, and was surprised to find that one species, at least, continues to work throughout the night and, to some extent, during rains. The detailed observations may be summarized as follows:

July 22—A caravan, *Crematogaster lineolata* (Say), was moving back and forth from a nest, located between the flooring and sub-flooring of a porch, to the topmost branches of a maple tree, where a colony of aphids were being milked for honey-dew. The distance traversed was about 40 feet. The workers leaving the nest carried sand and bits of dried mortar from crumbling masonry; those moving in the opposite direction evidently transported honey-dew. The sand and debris were being used to build a shelter over the aphids. The column was actively moving when first observed at 4 p. m., and at 11 p. m., two hours after dark, appeared undiminished in numbers and activity. The average speed of the workers was about two feet per minute, which enabled them to cover  $5\frac{1}{2}$  feet or, one "ant-mile,"<sup>1</sup> 15 minutes being required to traverse the entire route of 40 feet. Thus an individual was traveling 360 ant-miles in a 12-hour period, if no time be deducted for loitering. As it is apparent from the observations below that ants may work not only 12 hours at a stretch, but for much longer periods, it will be seen that they possess great energy.

Between 11 p. m. and 3:30 a. m. of July 22 a thundershower occurred, abating by the latter hour. At that hour the ants' route was drenched with water, but the ants were found to be working in as large numbers and in as compact order as during the previous afternoon. About half their route ran underneath a floor, the remaining half extending across clay-covered ground

<sup>1</sup>An "ant-mile" is a convenient unit of measurement obtained by comparing the length of an ant's body with that of a man's in relation to a mile.

and up the maple tree. Slight showers were found to have no effect upon the ants' labor as they retreated to cover only during heavy, washing rains. When retreating, the food-bearers proceeded back to the nest and the majority of those that were outward-bound congregated at the end of the dry limit of the route. As soon as the rain abated they resumed activity. During their wait they did not rest, but moved about continually in the dry area.

July 23 (6 a. m.)—There appeared to be as many individuals in the line as ever, but the speed seemed a trifle slower, and a few individuals were loitering an inch or two outside the working-line. At 8 a. m. the line appeared to be going full speed; at 2 p. m., the same, except a half-dozen loitering in a fleck of sunshine (cool temperature had prevailed for some hours). The loiterers were never entirely still, however, frequently moving about in a small area. At 9 p. m. the line was as strong and rapid as ever, except where snails were crossing the route, which caused some ants to stop and feed on their slime.

July 24 (6. a. m.)—The line going full force; at 10 a. m. it was a little straggly. Weather sunshiny except that part of the course leading up the tree. At 5 p. m., the line unusually strong and more sand than usual being carried up.

No more observations were made at Durham until 21 days later. On August 14 (4:30 p. m.) the line was found to be as strong in numbers and movement as on the previous dates. At 8 p. m. the line was thicker than previously observed, and it was estimated to contain twice as many ants as it had contained at its lowest ebb. Instead of moving in single file, the line was five or six individuals deep in places. At 8:30 p. m. the marching ants appeared no less numerous. On August 15 (2 a. m.) there was still no diminution apparent. The weather at that hour was foggy, with diffused moonlight. On August 16 (6:30 a. m.) the line appeared to be moving at approximately half the strength of the night preceding. The weather was cloudy. On August 17 (daybreak) the line was moving in full strength.

No more observations were made this particular colony until some two weeks later. In the meanwhile, suspecting that

this all-night work was not an unusual occurrence among ants, I made casual inspections of a nest of *Crematogaster lineolata* at Black Mountain, N. C. These inspections, made around 9 o'clock in the evening, never revealed under my flashlight more than a half-dozen ants wandering about on the flagstones near the nest. Their comparative scarcity may be accounted for by the fact that the weather was cold at this station.

After August 14 I attempted to discover other night-working species at Durham. At 10 p. m. of that date I detected two or three individuals of the small black ant *Monomorium minutum* var. *minimum* Buckley gathering dry grass seed. I subsequently baited several spots with honey. During the day this soon attracted *Monomorium* as well as a dozen or more individuals of the large brown ant, *Formica pallide-fulva* Latreille.

I then made an examination in the early morning, before daybreak, and at the baited stations found only *Monomoriums*. A further search of the locality, however, revealed the little black ants milking aphids on the tender shoots of an apple tree. The heart-shaped *Crematogaster* species was also found harvesting grass seed, but though extensive search was made, none of the *Formicas* could be found, nor have I yet found any of this species working at night.

Observations at Durham were then suspended until September 2, when at 8 p. m. the working line of the *Crematogasters* was still found to be operating in full force. On September 3 (8. a. m.) the line was straggling, there were fewer individuals working and I observed for the first time what might be called sleep on the part of these ants. In a section of the line 7 feet long I observed that there were now only thirty ants, hardly a fourth of the number observed on other occasions. Six of these were apparently sleeping but were probably not totally unconscious, or if they were, were easily awakened. As the line of march at this point traversed the under side of a floor the ants were traveling with their backs toward the ground. The resting individuals were motionless, with legs and antennæ tucked in, but when approached by passing workers for the usual kissing salute the dormant ones immediately held out their antennæ and a passerby

would go on with no more than a slight touch, apparently respecting the siesta hour of its comrade.

On September 3 (10:30 a. m.) the traffic was even lighter, so that not more than twenty ants could be counted at work in the whole procession. This was by far the largest falling off in workers observed during the entire summer, either by day or night. At this time seven sleepers were counted along the line, the remainder of the workers, whether asleep or awake, evidently being in the nest. On September 4, with warmer temperature, the line was again moving in full force. With lowering temperature the work gradually slowed down until on September 24, at sunrise, only one benumbed individual was out and at 7. a. m. (temperature 50) for the first time since the beginning of my observation in July, not a single individual was to be seen. On October 15, at noon, (temperature 59) six were out but moving slowly. This was the last appearance noted for the autumn.

In the spring of 1928 observations were made on the resumption of work by this colony. March 29, 6:00 p. m. (temperature 78) thirty-five individuals were seen to be following their old route. As the earth portion of the trail had been spaded under, it would appear that the ants followed the old route from memory and not as an odor-path. They followed exactly the same course up the tree but carried no building material, and by their movements appeared to be scouting. Until May 22, the last date of observation, the line continued to move steadily along the old trail except in very cold weather; and on the above date I observed that a few individuals were carrying sand up the tree, though apparently without any definite purpose, and as if they were merely acting upon a recollection of last season's activities.

It is realized that the foregoing observations are fragmentary and it is hoped that other observers will make a more extensive study of the subject. However, I shall venture to make a few surmises, rather than conclusions, from the limited data secured. The foregoing observations lead me to believe:

1. That excitement, caused by such circumstances as the discovery of aphids, or perhaps the building of a new nest, or

some other general disturbance, seems to occasion an outburst of prolonged activity among ants, at least in some species.

2. By the fact that the working line is considerably reinforced or diminished at certain times, it is possible that ants may work in relays, so that one portion of the colony may be resting in the nest while the other portion toils. Considering the fine point to which ants have developed their division of labor among various castes such a relay system could hardly be said to be beyond their powers. It may also be that ants require less rest than heavier animals, so that by a mere change in their rate of speed or by absorption of moisture or sunshine they receive renewed vitality.

3. The *Crematogaster* is probably a common night-worker, at least in North Carolina.

4. *Formica pallide-fulva* probably prefers to work in the sunshine rather than at night. The fact that this species is largely a flesh-eater may have some bearing on the matter, as its prey may be more available in daylight hours.

5. It is probable that temperature plays a large part in the working hours of ants. Just as an ant-colony suspends work above ground in winter, with the exception of infrequent journeys of occasional community foragers, it seems reasonable to suppose that any perceptible drop in temperature would lessen activity. Altitude, also, probably affects the work of ants. I attempted to make some observations in this regard at the summit of Mount Mitchell (6711 feet) during the summer, but was unable to find any ants at all, even during the day. It is probably too cold and high there, as none of the night-serenading insects, such as katydids or crickets, were to be heard.